

Development and Operation of the Butterfly Conservatory

*A Rainforest Regeneration Project within a
designated UNESCO Biosphere Reserve.*

El Castillo – Arenal, Costa Rica

By

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Founder / Director**



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The Butterfly Conservatory

The Butterfly Conservatory Reception Center

The Conservatory is located in North Central Costa Rica, an area where two of Earth's massive tectonic plates meet, and via subduction the Coco (Pacific) Plate is being forced downward and under the Caribbean plate, pushing liquid earth from the mantle to erupt and form volcanic mountains. Thus consequently forming the Arenal Lake valley, the Continental Divide in this country, and the many of the volcanic peaks in this area where rain-forests transform to cloud-forests at the higher elevations. For these reasons, the United Nations Educational, Scientific and Cultural Organization, (UNESCO) has established the area as a Biosphere Reserve.



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04/07/2007

Photos, taken from our Reception Center parking area. We are located 7 Km from the Arenal Volcano, one of the most active volcanos in the world. The primary rainforest in this area was cut in land grant programs to create cattle ranches, but they ceased to function about 15 years ago due to land depletion. The Conservatory was founded in 2002 with the intention of establishing an interactive educational project about how butterflies and nature can be regenerated.

We have a special focus on butterflies, while also demonstrating other tropical rainforest species, such as frogs, lizards, fish, and plants of the Arenal region of Costa Rica. The project has now grown to contain the largest exhibition of butterflies in Costa Rica, and is a learning center for understanding the butterfly life-cycle and incredible metamorphosis experience.



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Rainforest River Walk

Butterfly Creek

Heister Trail

Reproduction Nurseries

Orchid Abituro

Host Plant Garden

Volcano View Gazebo

Field House

Frog Habitat

Fish Pond

Lowland Open Field Habitat

Inside of Forest Habitat

Highland Area Habitat

Edge of Forest Habitat

Insect Museum

Laboratory

Medicinal Herbs

Botanical Gardens

Parking

Artist sketch of the layout of our gardens. Only the primary trails are shown, we have another 3 acres with 5 more greenhouses on the other side of Butterfly Creek.



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This photo shows our four Atrium Habitats that correspond the 4 ecological areas around Lake Arenal (1. highland forest, 2. edge of the forest, 3. lowland open field, and 4. inside the rainforest). We adjust each habitat with plants, light, air flow, etc., to be comfortable for the over 1000 butterflies flying here, representing more than 30 species from this area.



Exhibition Atriums

(Flight Houses)



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Here I am with the Morphos inside the Highland Open Field Habitat. The structure of these atriums are supported by a 5/8" rolled steel bar matrix, assembled in arcs using supporting struts. These then are welded together with longitudinal struts creating a very sturdy structure that we can walk on for cleaning, and has stayed in excellent shape since 2002. And once the (30%) shade shade cloth is stretched over it, and 8mm plastic over that, it forms a controllable habitat. Air flow is through the ends of the atriums, with humidity and participation controlled using fog nozzles and sprinklers.



Inside the Morpho Atrium, a pair mating on the left. 1. We are experimenting with "Magic Mesh" for doors on isolation chambers between atriums. 2. View from inside chamber looking out into Atrium #2 through the Mesh door. 3. Tourist attacked by multiple Tithorea terricina butterflies.



We use several methods of raising butterflies, depending on the species.
Here are some photos taken in our Laboratory of how we raise butterflies on cut food, mostly in “shoe box” size containers. Each box contains ~25 larvae and is tended daily.



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The golden chrysalises of *Tithorea terricina*. They have pupated at the top of the tub on their own. Looking like little reflective jewels, they create a good defense when hanging from a leaf, with the sun glaring back at predators.



First thing every morning is to collect fresh host plants from our gardens and bring into the laboratory. (we use cut food in tubs inside the lab). Outside the lab we use sleeved potted plants a la the "Max" method, but apply it to many other species. Below is Ana Grace, our "Mother Butterfly" at the Conservatory, here she is changing the diapers of Parides. We use recycle vitamin bottles for vases, and keep the sanitized tubs and lids handy. Notice the 100 newly emerged Heliconius Doris in popup.



Host plants in the lab are cleaned and prepared for use in 5 lt tubs, as per our SOP's. Food quantity is determined by production quotas, and instar of each species in the lab production schedule. In actuality, many other factors influence what we raise at any specific time of the year, for example host plant availability, or difficult seasonality. The plants are laid out to be in the same order as the larvae containers on the shelves: 1st instar to oldest, and then by species order.



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Wash and sanitizing area for tubs, outside the Lab. This is where we wash all sleeves, pop-ups, and raising containers in Chlorine using various tank sizes, including a 55 gal drum for Chlorine soaking. Also all raising containers are passed through wash tanks with a “Bordeaux mix” for prevention of fungus. This is basically a bath in large drum of water with copper sulfate crystals, and a little hydrated lime. The French have used this successfully for years to control fungus in the Vineyards, and it isn’t harmful to butterflies. We also apply this mix directly to plants in our flight atriums when we have a fungus problem, larva's can eat the leaves after a quick water wash down.



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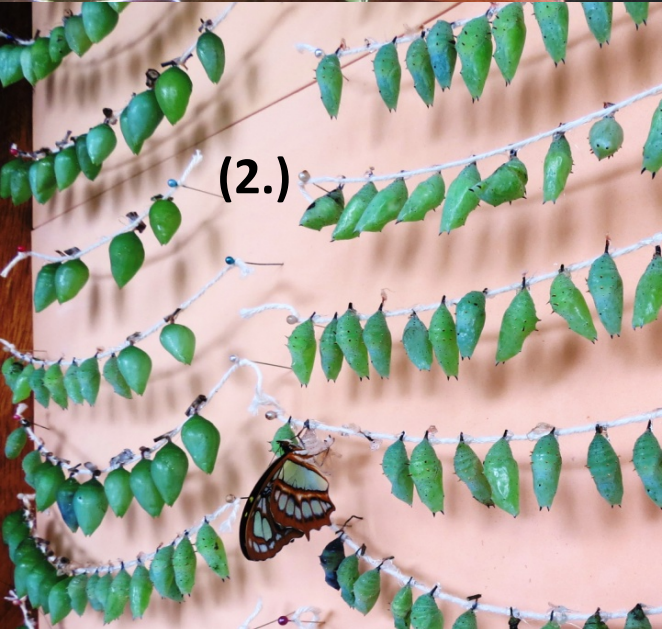
We also use pop-ups for protecting larvae we raise on both cut food & and potted plants. The pop-ups for the more delicate species are located at the opposite end of the Lab from the tub changing area. Other more hardy species are raised in pop-ups placed along the wall outside the Lab.



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Our butterfly Life-Cycle display is in one corner of the Reception Center, here we have the primary pupario, eggs and larvae of several species for demonstration.

1. Pupae being glued to cotton cord,
2. The pupae are then hung in the Pupario,
3. Larvae & pupa of *Tithorea teracina*,
4. *Parides iphidama* larva,
5. Pop-ups with today's freshly emerged butterflies.



Our "Puparios" or emerging cabinets are made by us.
We like the size 90 x 120 x 30 centimeters. We utilize Plexiglas doors, with screened side ventilation ports. We attach the pupas to a cotton cord, and then use pins to hang them onto the synthetic cork backing. Old newspapers (or paper towels) are used on the bottom to absorb the meconium mess, and a strip of plastic is placed under the paper which makes it easy to clean up the residues of newly emerged butterflies.



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We have a large variety of host plants throughout our 13 acres of gardens, and take advantage of them to “ranch” certain species of butterflies in sleeves. 1. We use anti-aphid cloth for the sleeves, and isolate the bags from crawling predators with a little grease on the stem, 2. Morpho larvae on pero, 3. Caligo larvae on Heliconia plants, 4. Ana Grace changing sleeves inside a host plant greenhouse.



(1.)



(2.)



(3.)



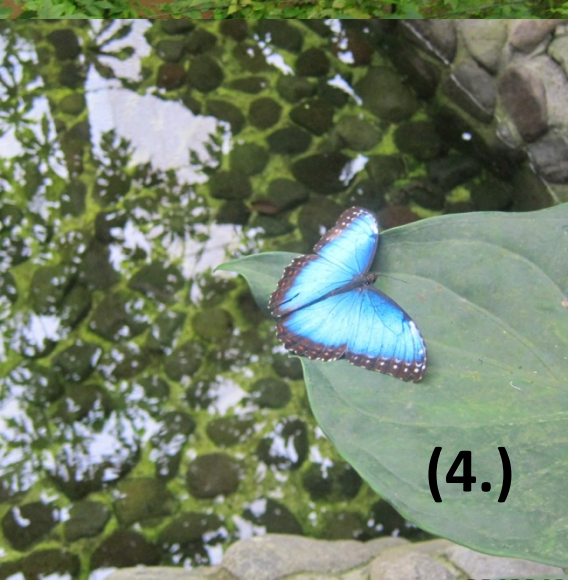
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Growing healthy and abundant host plants is critical to success, we grow in excess of our needs so the best food can be chosen. 1. seed plant greenhouse, all species started here. 2. passiflora greenhouse, 3. Atrium for experimental studies, all host plants are in this garden. 4. Vitifolia outdoors, 5. Passiflora Seemannii outdoors.

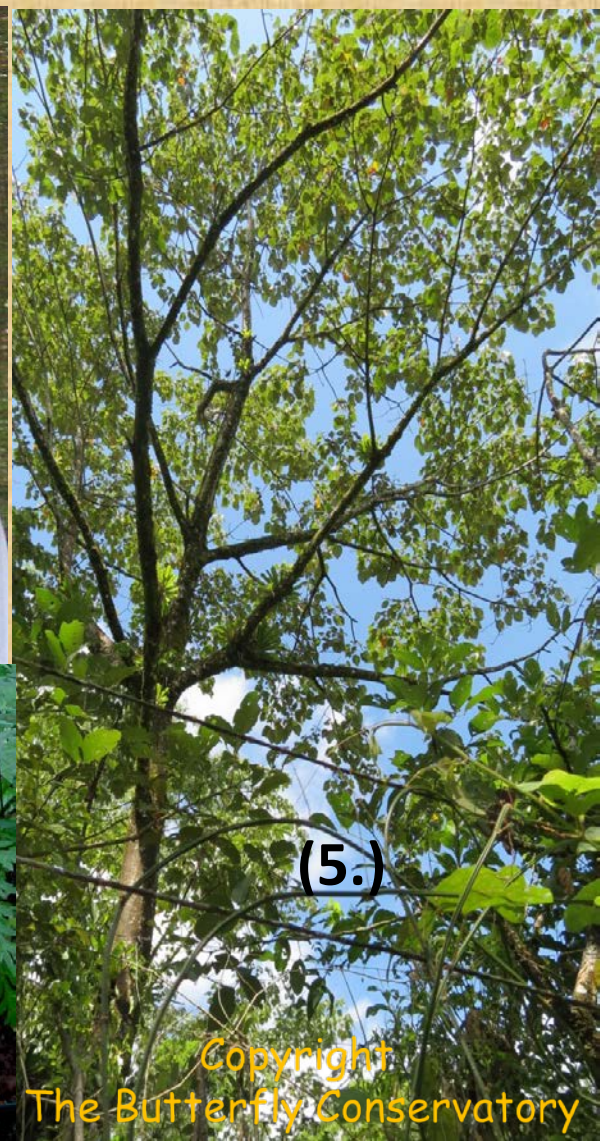


Views in the gardens. 1. Pop-ups in greenhouse #5 with Siproeta larva on potted plants. 2. Congo monkey reaching for food in the gardens. 3. Experimental Atrium. 4. Morpho sunning on leaf over reflection pool. 5. Iguana Pond, note the host plants in bags ready for transplant, & Goldi my golden retriever. 6. Frog Habitat & Orchid Atrium.



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More views in our gardens. 1. Our Wedding Gazebo with views of the lake and volcano. 2. The field storeroom where we keep tools and equipment for working in the gardens. 3. Siporeta ephaus surprises a visitor, 4. Ana Grace has painted rocks with butterfly faces, and puts them throughout the gardens, 5. The magnificent Balsa Tree, if you've ever made a model airplane, this is where your wood came from.



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A selection of species we raise are seen below.
These photos were taken in the Atrium Habitats.



Heliconius sara



Heliconius hecale



Hamadryas amphinome



Heliconius doris



Greta oto



Heliconius erato



Siproeta epaphus



Eueides isabella



Heliconius cydno



The Caligo family is the largest specie of butterfly in Costa Rica.

1. The incredible eye mosaic of scales on the wing is impressive, 2. Caligos feeding on Fermenting fruit. 3. Mature Caligo memnon 4. Owl's face, made by Caligo eurilochus. 5. eurilochus attraction side. 6. Caligo atreus, attraction side.



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Standard Operating Procedures

It is important to have written SOP's for your operation. This should be a written document, with instructions detailing all steps and activities of a process or procedure. For Butterfly Breeding, it standardizes how each specie is raised, and more importantly how to prevent potential problems, complexities, and diseases. It provides critical documentation and methods for all aspects of daily project operations, which should be managed and implemented.

ISO 22000 requires the documentation of all procedures used in any process that could affect the quality of the product.

Why SOP's are important to efficient operations?

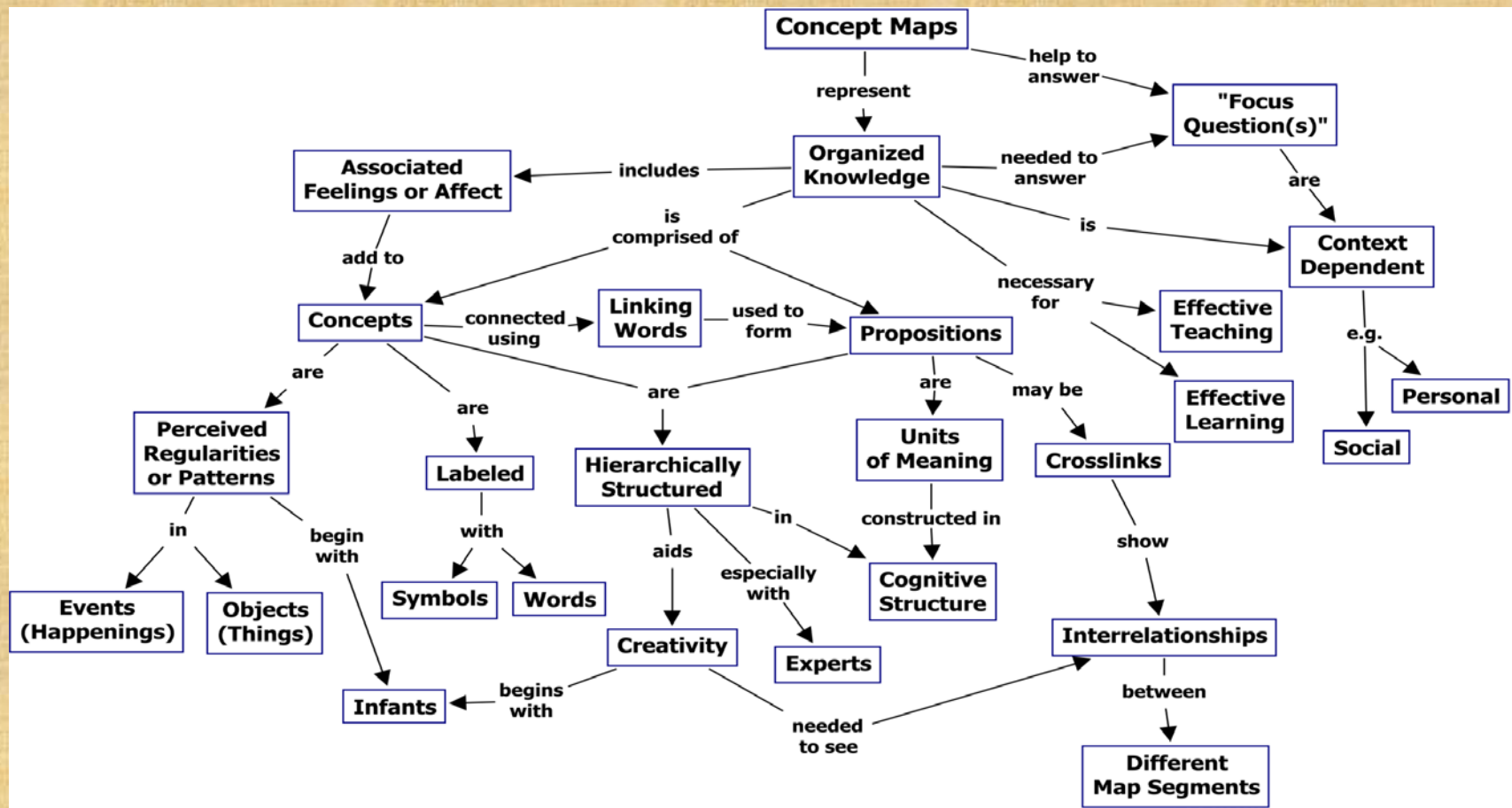
- They standardize the approach of individuals doing specific procedures.
- They can improve the quality and speed of a process
- Provide valuable structure for understanding overall operation and best practices.
- They act to disseminate best practices within your business, and can be easily updated as the conditions and legislation requires it.
- Simplifies the induction and training of new personnel

What is C-Map technology?

The C-Map Tools program is a structured interactive set of software tools, that allow the user to link any type of resource (photos, images, graphs, videos, charts, tables, texts, WWW pages, etc.), to create *Concept Maps* using data located in your personal files, or anywhere on the Internet.

These resources are shown as links or icons that can be clicked for further detail, to connect and illustrate the knowledge relationships among concept maps in a set.

You then organize the C-maps into a hierarchical structure allowing ease of access and understanding of your operations.



Advantages of using Cmap Technology for SOP's

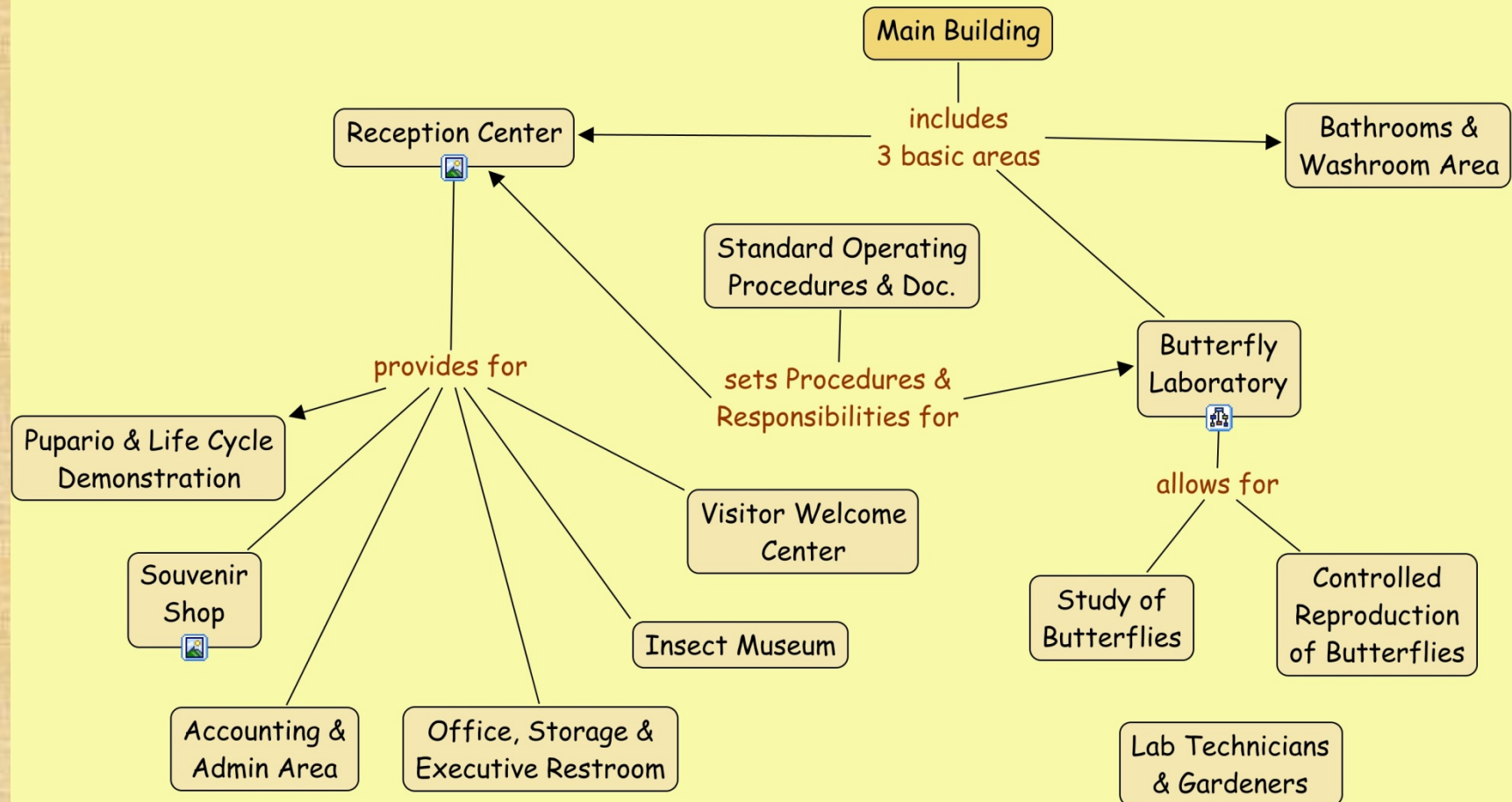
- **Presents process structure in a standard and clear fashion.**
- **Easy navigational tool for connecting domains of knowledge.**
- **Much easier to identify the important concepts.**
- **A sophisticated learning and teaching tool**
- **Captures knowledge of experts with the details of an operation.**
- **Greater understanding of overall business structure and planning.**
- **Helps in the creation of shared values.**
- **Hierarchical organization of ideas creating optimal sequencing of resource materials.**

C-Maps were first used for the NASA Mars Rover Program, and then later released to the public as free software by IHMC the creators of the program. You can download the Cmap Tools software set free of charge at:

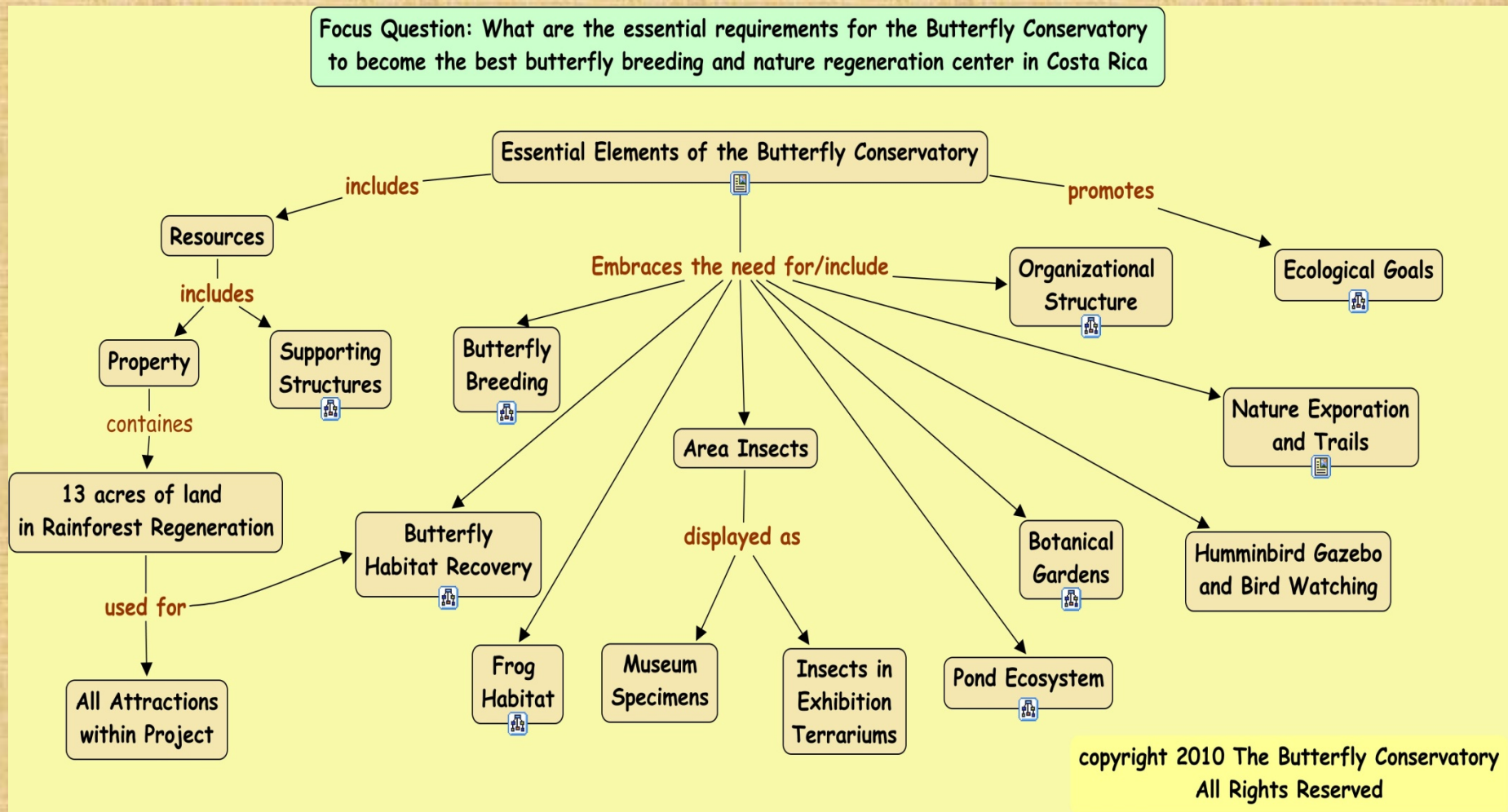
<http://cmap.ihmc.us/download/>

The following slides show example Cmaps for the Butterfly Conservatory. We use more than 20 Cmaps to describe our entire operation. Notice how the boxes link to further detailed Cmaps and other types of documentation to form an integral sequence of information and data to support each layer in the Cmap structure.

Focus Question: What are the functions of the Main Building

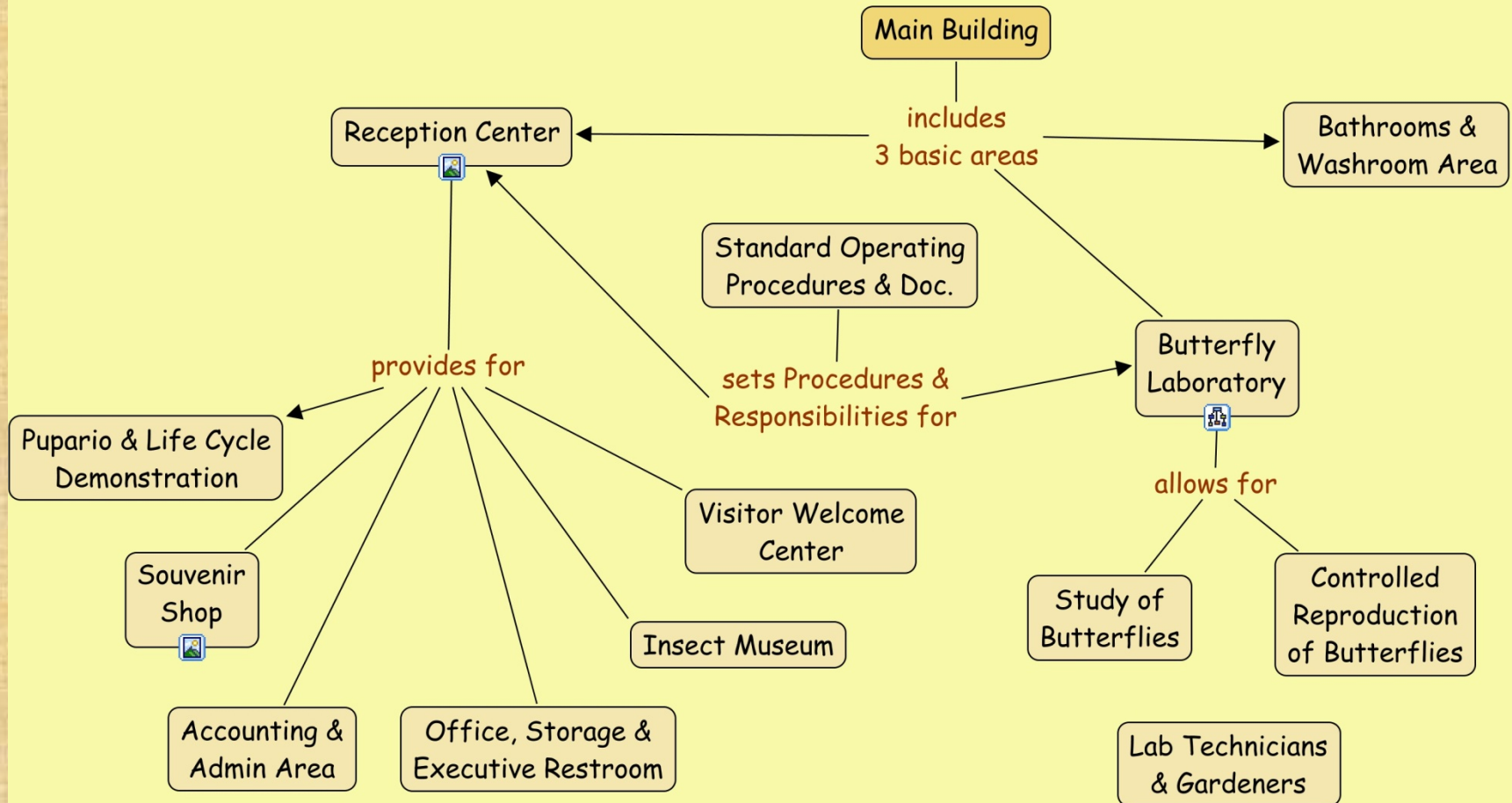


Each Cmap starts with a focus, and then develops downward describing the supporting elements for implementation, where each layer provides more detail. When a major category is identified, such as “Butterfly Breeding” or “Supporting Structures” there will be an icon beneath it, and by clicking it opens the next level Cmap. This one shows the Essential Elements for the Butterfly Conservatory.



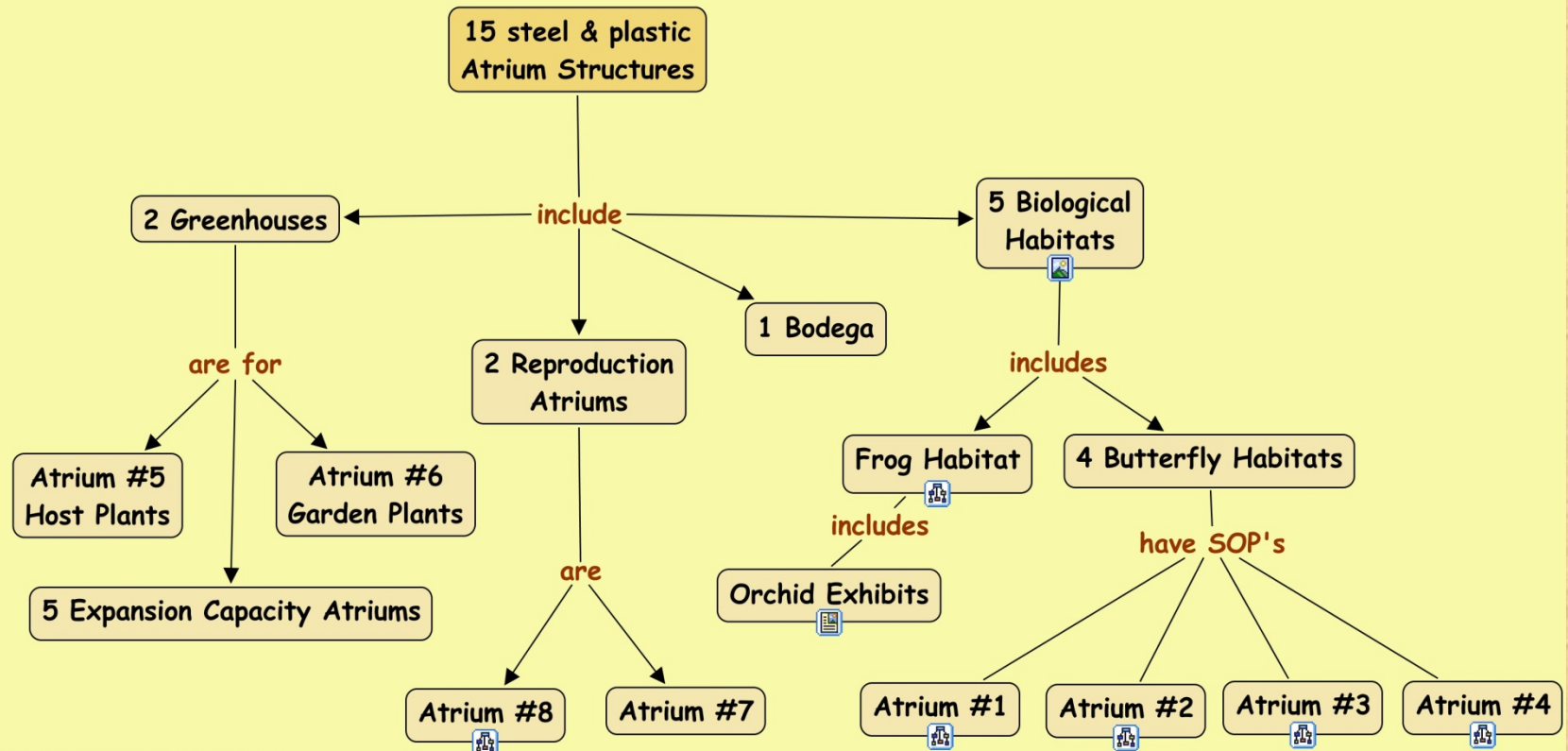
This Cmap describes all the functions the take place in our main building, the Reception Center. When these maps are fully populated with links to photos, documents, etc., then they provide a useful structure for viewing operations.

Focus Question: What are the functions of the Main Building



This Cmap describing all of our Atrium Structures is an overview of our garden resources. The current use of each structure is further described in additional Cmaps that are linked to each of the boxes. Please note that the example Cmaps I've shown in this presentation are from 2010, before they were fully populated. They have all been completed since then.

Focus Question: How are the atrium structures utilized?



Butterfly Conservatory



A Rainforest Regeneration Project
"Find your awareness in nature"



End of Presentation
Come visit with us!